## 1. Introduction and Overvi w

In the second office action Claims 1-3, 8-10, 12, 14 and 15 were rejected; the rejection was made final by Examiner. Claims 4, 7, and 13 were objected to. Claim 11 was allowed.

Claims 1-3, 8-10, 14 and 15 were rejected under 35 U.S.C. 103(a) over **Ramarathnam US Patent No. 6,316,895 B1** in view of **Joyner, Jr. et al US Patent No. 4,308,491**. Claim 12 was rejected under §103(a) as being unpatentable over **Ramarathnam** in view of **Slate et al US Patent No. 4,919,596**. Claims 4, 7 and 13 were objected to as being dependent on a rejected base claim (Claim 1). **Ramarathnam** and **Joyner, Jr. et al** constitute new references cited by Examiner.

A brief summary of **Ramarathnam**, **Joyner, Jr. et al** and **Slate et al** is as follows:

**Ramarathnam** teaches a controller utilizing pulse width modulation (PWM) to generate a variable frequency and variable amplitude sinusoidal waveform used to vary the speed of an AC induction, reluctance or synchronous motor. In **Ramarathnam's** scheme the frequency of PWM is **not** the driving frequency of the motor as in the applicants' case, but is several times higher. **Ramarathnam's** PWM is used to generate a sine wave input to the motor wherein the higher the frequency of the PWM, the more accurately sinusoidal is the drive to the motor. Obtaining high sine wave fidelity is an explicit goal in **Ramarathnam.** The inventor explicitly states (pg.1 lines 29-32) that "... it is necessary to ensure that the output waveforms are as near to sinusoid as possible to minimize harmonic effects and reduce losses, noise and vibration. " (*Note:* **Ramarathnam's** *invention primarily addresses 3-phase induction motors for which a separate waveform is generated for each phase.)* In fact, one of the aims of **Ramarathnam's** invention (page 2 lines 64-66) is to "vary the magnitude and frequency of the applied voltage, while keeping the output waveform of the

inverter as close to sinusoidal as required." While the frequency of each of **Ramarathnam's** resultant sine waves **is** the driving frequency of the motor, the frequency of PWM used to generate the sine wave **is not**.

It is noted that **Ramarathnam** discloses that in addition to controlling AC motors his scheme is also applicable to brushless DC motors (col. 3, lines 36-37). This would only be possible if the DC motor is modified so that the AC signal is applied directly to the field windings. In this case the motor ceases to operate in the conventional DC mode and can no longer be called a "DC motor" even though specified as such in **Ramarathnam**.

**Joyner, Jr. et al** teach a pumping system wherein a plurality of pumps are driven by a plurality of variable speed AC motors controlled by a "control box".

**Slate et al.** teach a feedback controlled fluid delivery and control apparatus incorporating DC motors and a piston pump embedded into a disposable output cassette for accurately delivering fluid to a patient. **Slate et al** do not teach a "fountain system."

Before addressing the specific reasons for rejection in the office action, it is first necessary to address the issue of permanent magnet synchronous AC motors as addressed by Examiner in the second office action, Section 1, page 2.

## 2. Regarding Permanent Magnet Synchronous AC Motors (OA Section 1)

It is noted that in applicants' original disclosure and thereafter in Amendment A and in the current amendment, applicants have limited Claim 1 and 3 and amended claims 1 and 3 to AC permanent magnet synchronous motor pumps. The motor portion of these pumps is structurally different and internally functions differently than other AC synchronous motors not having permanent magnet rotors.

Examiner states (OA section 1 page 2) that "... all synchronous AC motors or synchronous DC brushless motors have permanent magnet rotors." No authority is given for this statement. If this statement were true, then in original Claim 1 and Claim 2 and in currently amended Claim 1 and amended Claim 3, applicants' limiting the motor pump to permanent magnet rotors would be moot - e.g. specifying "permanent magnet" would be just as meaningfully limiting as specifying the color that the motor housing is painted.

The above-cited statement of Examiner is not correct in two respects:

**2-A. DC Motors**

The term "synchronous DC brushless motors" has no meaning. A DC motor by definition cannot be synchronous, as there is no component within a pure DC supply to which the motor can synchronize. Applicants made a similar argument in Amendment A to counter Examiner's contention that applicants' motor was a brushless synchronous DC motor. It is however possible to drive many types of brushless DC motors as AC motors by bypassing the internal electronic commutation mechanism, in which case the motor effectively becomes an AC motor. When driven as such from an AC source, the motor can no longer be considered to be a DC motor. The specific reference to DC brushless motors in Ramarathnam's disclosure requires that the above modification be made in order for **Ramarathnam's AC** drive to function.

**2-B. AC Motors**

There are a number of examples of brushless AC synchronous motors that do **not** have permanent magnet rotors and these are well know art. One type is the very common reluctance-type synchronous motor. Motors of this type typically have "non excited" iron rotors with specific shapes designed to channel the induced magnetism into paths which synchronize the rotor to the

rotating field produced by stationary field coils. There are also types with a construction similar to “squirrel cage” induction motors but with certain sections of the cage removed to achieve fixed magnetic polarization of the rotor at normal running speeds.

Another form of brushless AC synchronous motor without a permanent magnet rotor is the hysteresis motor. In this type of motor the rotor is typically a smooth hard steel cylinder with high magnetic retentivity. In operation, the field coils induce a magnetic field into the rotor. This field will tend to remain static with respect to the rotor at low torque. These types of motors are common in clock drives. All three of the above types of motors are generally small and are used only in low torque applications.

Additionally, there is a class of brushless AC synchronous motors not having permanent magnet rotors that is typically used in large-scale applications such as in ship propulsion pods. In these motors the magnetic polarizing energy for the rotor is developed by AC generator windings attached to the main motor shaft which rotate within a static magnetic field generated by an external excitation current. The AC current from these rotating generator coils is rectified within the rotor assembly and fed to windings embedded in the main rotor to provide the fixed magnetic polarization for the rotor.

There are many variations of these types of motors, none having permanent magnet rotors, as well as other types which either by magnetic induction or by other means produce magnetic fields in the rotating part of the motor without the use of brushes or other forms of electrical (as distinct from magnetic or optical) contact with the rotor.

**2-C. Applicants' AC Synchronous Motor Pump**

The term "motor pump" has been used throughout applicants' disclosure (see, for instance applicants' disclosure pg. 3, lines 7-11) as has the term PMSM

pump (see, for instance applicants' disclosure pg. 8, lines 8-11) to refer to a pump comprised of an AC permanent magnet synchronous motor having an internal magnetic rotor and coupled impeller (see applicants' disclosure, pg. 4, lines 27-28 through pg. 5, lines 1-2). Applicants' AC PMSM pump is an integral unit. Limiting the motor pump to an AC permanent magnet synchronous motor pump in Claim 1 and Claim 3 and amended Claim 1 and amended Claim 3 distinguishes from the general class of AC synchronous motors without permanent magnet rotors that are used to drive **physically separate** pumps. Many of these motors without permanent magnet rotors are multi-horsepower, many are three-phase and the majority are rigidly shaft-coupled to high flow rate pumps. (Note that some of these have flexible - rather than fixed - couplings to obviate shaft mis-alignment).

Permanent magnet synchronous motor pumps on the other hand are designed to be submersible and are generally fractional horsepower, have low flow rates (typically less than 2000 gallons- per- hour) and are designed for a 100% duty cycle. These integral motor-pump units are used extensively in aquarium and small fountain applications since by design the rotor and the impeller are immersed in a common liquid (e.g. water). (Note that "sump pumps", which typically do not have permanent magnet rotors, do not have this feature and generally are designed for intermittent duty).

Advantageously, for AC PMSM pumps, liquid immersion prevents the rotor bearing system from overheating. Further, to avoid startup problems, these motor pumps generally allow the rotor and impeller to rotate between fixed stops relative to each other. Significantly, the rotor and impeller are normally **not** rigidly fixed to one another. These distinctions are important to applicants' arguments for allowance to follow.

**3. R j ction of Claim 1 under §103(a) ov r Ramarathnam in view of Joyner, Jr. et al is overcome**

Applicants have amended Claim 1 to more clearly annunciate the novel and non-obvious features over **Ramarathnam** in view of **Joyner, Jr. et al** and to further distinguish over the prior art.

In Claim 1 and Claim 1 amended, applicants specify an AC permanent magnet synchronous **motor pump** (emphasis added). It is clear from this description that the magnetic rotor and impeller **are part of the integral motor pump**. This would obviate a permanent magnet synchronous motor, for example, which is coupled via a shaft to a separate pump which in turn includes an impeller. The language of Claim 1 and amended Claim 1 clearly annunciates this point. In no place in applicants' disclosure is there mention of a separate motor and pump. In Examiner's rejection of Claim 1, Examiner states that "it would have been obvious ... to use Ramarathnam's motor to run Joyner's pump to achieve the same subject matter as claimed." Since Claim 1 and amended Claim 1 specify the control of a motor pump which is both structurally and functionally integrally combined, and **Joyner, et al** teach a plurality of separate pumps driven by a plurality of separate AC motors, the claimed feature of **Ramarathnam's** "motor" used in place of **Joyner**'s motors to drive **Joyner's** pumps is lacking in Claim 1 and amended Claim 1. Further, **Ramarathnam** and **Joyner, et al** are individually complete and functional within themselves. **Ramarathnam** discloses a controller for generating sinusoidal waveforms to drive an AC motor. **Joyner, et al** discloses a pumping system comprised of variable speed AC motors and separate pumps controlled with a "control box". There would be no reason to substitute **Ramarathnam's** motor controller for **Joyner's** "control box" to vary the speed of **Joyner, et al's** motors unless the suggestion came from applicants' own disclosure viewed in hindsight. Finally,

**Ramarathnam** does not teach a motor - he teaches a motor controller. These arguments argue against **§103(a)** rejection.

It is appropriate to spell out the major differences between applicant's amended Claim 1 and the teaching of **Ramarathnam**.

**Ramarathnam** describes a method of generating sine waves using cyclic PWM to drive an AC motor. In **Ramarathnam's** disclosure, the motor driving frequency is the sine wave frequency and **not** the PWM frequency. This is an important distinction between applicant's disclosure and amended Claim 1 (see **Ramarathnam** Fig. 4) and **Ramarathnam's** teaching.

In **Ramarathnam** the motor is driven by a waveform produced by a PWM waveform of much higher frequency than the driving frequency. This PWM frequency is typically at least 4x to 5x and more likely an order of magnitude or more higher than the driving frequency. The waveform in **Ramarathnam** is specifically tailored to produce with reasonable accuracy an AC sine wave of the type for which the motor was specifically designed, e.g. an AC sine wave such as is supplied with a common AC power line supply. Such an approach of generating sinusoidal waveforms using cyclic PWM is common practice. Importantly, it is noted that even for a given motor speed, the frequency of the PWM in **Ramarathnam** is not of necessity related to the output frequency sine wave or to motor speed. That is: In **Ramarathnam's** case the PWM frequency is clearly not linked harmonically to motor speed whereas the sine wave that the PWM generates **is** harmonically related.

In applicants' disclosure and in amended Claim 1 the motor driving frequency **is** the PWM frequency which **is** the synchronizing mechanism and is therefore directly related to the motor pump speed. Note that in applicants' disclosure (page 9, lines 21-24) the frequency, f, which is specified, **is** the frequency of the output pulse waveform driving the motor pump. For a synchronous AC motor, the speed of the motor **must** be in synchronization with

this frequency (see **Walker** technical definition quoted below). It is well known in AC motor art that a synchronous motor synchronizes to the predominant, lower frequency component (this is the driving component) of the applied waveform. In **Ramarathnam** this is the sine wave component of the multi-component waveform. In the applicants' amended Claim 1 it is clear that there exists only one predominant frequency component which **is** the driving component. The AC pulse switching signals of amended Claim 1 are not a sine wave and amended Claim 1 neither explicitly or implicitly describes the generation of such a waveform as taught in **Ramarathnam**.

The following definitions of *synchronous motor* and *synchronous machine* are in order: In Walker, P., Ed (1988) Chambers Science and Technology Dictionary. Chambers/Cambridge. New York. pg. 878, a synchronous motor is defined as an "A.c. electric motor designed to run in synchronism with supply voltage." Such motors retain synchronization with the **frequency** of the voltage applied to the motor. Further, a synchronous machine is defined in Walker as " An a.c. machine which rotates at a constant speed which is harmonically related to the frequency of the supply to which it is connected. If the machine is two pole, it will rotate at the supply frequency: if 4 pole, at half supply frequency, and so on." (pg. 878). In other words, the harmonic relationship is solely related to driving frequency and to the physical characteristics of the motor (i.e. the number of poles).

In applicants' disclosure a specific aim of the invention was to vary the flow rate of an AC PMSM pump by varying the frequency input to (driving) the motor pump and by correspondingly varying the pulse width such that the motor pumps power requirements are met over the widest range of motor pump **speeds** realizable (see applicants' disclosure pg. 3, lines 7-11, emphasis added).

Amended Claim 1 spells out these distinctions explicitly with the following language: " .... *varying the flow rate of said motor pump over an extended range*

*of flow rates in accordance with AC pulse switching signals applied to said motor pump further comprising means setting the frequency of said AC pulse switching signals for obtaining a given speed of said motor pump,* ***wherein said speed is synchronous to said frequency for all realizable speeds of said motor pump****...." (emphasis added, see above pg. 13, lines 23 – 28, pg.14, line 1). It is noted that amended Claim 1 patentably distinguishes from the pulse width modulation used by **Ramarathnam** to generate a sinusoidal waveform.

Further, amended Claim 1 specifies means of setting the pulse width in relation to the driving frequency with the following language: *"... further comprising means setting the pulse width of said AC pulse switching signals in relation to said frequency for a given motor speed in order to maintain constant and continuous flow for any given realizable speed of said motor pump...."* In **Ramarathnam** the PWM changes cyclically with the motor revolution. (e.g. the pulse width is proportional to the amplitude of the relevant part of the generated sine wave at any given moment in time) for any given fixed motor speed. In applicants' disclosure and amended Claim 1 the pulse width remains constant for a given fixed motor speed and pulse width changes (e.g. modulation) only occur as the intended motor speed changes.

The above distinctions, enunciated in amended Claim 1 strongly distinguish over **Ramarathnam** and the prior art.

Amended Claim 1 eliminates a major element of **Ramarathnam** - that is the computationally intensive generation of the higher frequency PWM waveform used to produce the lower driving frequency sinusoidal waveform required to synchronously drive the motor. Applicants' simplification - only AC pulse switching signals at the synchronous driving frequency are generated - makes it possible to control the AC PMSM pump of Claim 1 over a wide speed range while greatly reducing controller processor requirements. This simplification is important in terms of economic considerations and is a compelling argument in

overcoming potential **§103(a)** rejection of amended Claim 1. Novelly, because this simplification reduces computational demands on the microprocessor of amended Claim 1, applicants' processor program cycles at a considerably lower rate (therefore resulting in a much lower task overhead) for a given processor (micro controller) type and speed. Consequently more time is available for the processor to complete other tasks (e.g. A to D conversion, control program sequence, user input, external control code decoding etc.). This obviates having to rely upon a more powerful or second processor to perform such work.

Applicants' invention enunciated in amended Claim 1 also constitutes an unsuggested modification to the invention of **Ramarathnam.** In fact, **Ramarathnam** teaches in the other direction - that is - arguing toward obtaining higher sine wave fidelity balanced by processor constraints. This is another argument in overcoming potential **§103(a)** rejection.

Applicants' invention as enunciated in amended Claim 1 is also contrary to the teaching of the prior art and is a strong argument against potential **§103(a)** rejection. For example, it is natural to assume that since AC motors are designed to run on a sinusoidal waveform from the AC line, one should attempt to reproduce that waveform as closely as possible in any mechanism designed to effect a speed change by changing frequency. That is exactly what **Ramarathnam's** invention spells out. (See Amendment B, section 1 and **Ramarathnam** page 1 lines 29-32). In contrast, applicant's invention and amended Claim 1 specify a much simpler approach by driving the motor pump directly and in synchronism with the AC pulse switching signal frequency for all realizable speeds of the motor pump. Novelly, this approach significantly reduces computation-time overhead.

The invention has been implemented in hardware and software by applicants' and results in exceptional control of the AC PMSM pump of amended Claim 1. This could be viewed as an unexpected and surprising result -

especially in light of **Ramarathnam** - since applicants' pulse switching signals differ markedly from a sinusoidal waveform. Since **Ramarathnam** is primarily concerned with the control of large three-phase induction motors where the sinusoidal waveform issue is more relevant, the approach in **Ramarathnam** would be substantial overkill if used to control the low torque, low power AC PMSM pumps of applicants' invention. This is yet another argument against potential **§103(a)** rejection of Claim 1.

Novelly, applicants' **combination** of motor driving supply frequency control **and** Pulse Width Modulation control is used to considerably extend the working speed range over which an AC synchronous motor pump can be usefully varied in an economically cost effective manner. The invention is thus novelly and perfectly suited to control low cost, low flow rate AC PMSM pumps. Applicants submit that amended Claim 1 defines patentably over **Ramarathnam** and the prior art and is now in a condition for allowance.

### 4. Rejection of Claim 3 under §103(a) over Ramarathnam in view of Joyner, Jr. et al is overcome

Applicants have amended dependent Claim 3 incorporating the AC permanent magnet synchronous motor pump of cancelled Claim 2 with further limitation. Amended Claim 3 specifically limits to AC permanent magnet synchronous motor (PMSM) pumps wherein both rotor and impeller are immersed in a common liquid. This type of pump is normally submersible, however such pumps can be operated outside of a liquid environment by providing suitable liquid-tight couplings for inlet and outlet liquid. In this type of pump the motor and the pump form an integral unit. This is referred to in applicants' disclosure as a "motor pump". These motor pumps are typically fractional horsepower and, as pointed out in applicant's disclosure, are generally used in fountain applications.

In rejecting Claim 2 based on §103(a), Examiner states that **Ramarathnam's** motor is an AC permanent magnet synchronous motor which can be used to run **Joyner's** pump to output a flow of liquid. Applicants will respond to this statement since cancelled Claim 2 with further limitation has been incorporated into amended Claim 3. **Ramarathnam** teaches a motor controller - not a motor. **Joyner** teaches a pumping system where a plurality of variable speed AC motors and a plurality of separate pumps are controlled by electronics in an associated "control box". Each of these references cited by Examiner is complete within itself. While **Ramarathnam's** motor controller could conceivably be used to control each of **Joyner's** motors, such combination could only be made in hindsight in view of the applicants' own disclosure. Further, use of **Ramarathnam's** controller to replace **Joyner's** control box and external circuitry (see **Joyner, et al** Fig. 2) would require substantial and not necessarily straightforward modifications for such use to be operative. Additionally, amended Claim 3 comprises an **integral** motor pump - not separate motors and pumps as in **Joyner.** Finally, applicants note that even if **Ramarathnam** taught an AC PMSM, combining such a motor to replace each of **Joyner's** motors would not meet the subject matter of amended Claim 3.

Applicants will now address the rotor/impeller issues explicit in Examiner's rejection of Claim 3. In rejecting original Claim 3, Examiner notes that for "motor/pump systems", the method of connecting the rotor shaft to the impeller shaft is with a rigid screw-coupling. Examiner is clearly viewing such a system as having a separate motor driving a separate pump. Examiner also states that an impeller, rotor and coupling are all prior art. For pumping systems where the pump and the motor are separate units, this assessment is generally accurate subject to the provisos of Section 2-C above.

However, for the AC PMSM pumps of amended Claim 3, wherein the rotor and impeller are an integral unit which is immersed in a common liquid, fixing the

rotor and impeller so that they cannot rotate with respect to each other is **not** normal or common practice. Rather, the common and normal practice is to allow the impeller to have a limited degree of free rotation in both directions with respect to the rotor. [see for example **Cabalcante (US4247265), Ellis, et al (US 5282961) and Willinger and Ivasauskas (US4861468)**]. A common example of an AC PMSM submersible motor pump in wide U.S. distribution with this type of rotor/impeller coupling is the Rio® Aqua Pump 200 distributed in the U.S. by T.A.A.M., Inc., Camarillo, California. Without the limited-free-rotation of the rotor and impeller, pumps of this type will not reliably start upon being energized with a sinusoidal voltage from the AC line. This is due in part to the resistive force on the impeller due to the static water head and due to the typically low startup torque of such motor pumps. In these motor pumps, by allowing a limited degree of free rotation of the impeller with respect to the rotor, the rotor is allowed to begin rotation without the resistance of the impeller. Also, due to the smooth sinusoidal nature of the AC source, rotor/impeller chatter is eliminated when these motor pumps are driven at their design frequency from the AC line.

Amended Claim 3 teaches away from the above accepted practice of limited-free-rotation of rotor and impeller in the prior art for such motor pumps, which in itself is a compelling argument against a **§103(a)** rejection.

Regarding amended Claim 3, if the controller of amended Claim 1 upon which Claim 3 depends, were coupled with the limited-free-rotation rotor/impeller of the prior art described above, objectionable impeller chatter would result especially in the lower range of realizable pump speeds. This would be exacerbated by the pulse nature of the switching signals of amended Claim 1 (which are not sinusoidal), back pressure from the water head and the non-directional preference of the motor pump.

Regarding **§102(b)** novelty, rotor chatter is effectively eliminated with the fixed rotor/impeller of amended Claim 3 when coupled with the controller of

amended Claim 1. This allows the motor pump to function smoothly over the realizable range of motor pump speeds and associated pump flow rates. Also novelly, the controller of amended Claim 1 and the fixed rotor and impeller of amended Claim 3 result in reliable motor pump startup which is not the case if the motor pump is driven directly from the sinusoidal AC line and the rotor and impeller is fixed to prevent relative rotation. The reliable starting behavior of motor pumps of Claim 3 is a demonstrable consequence of driving the motor pump with a pulse waveform of the type generated by the controller of amended Claim 1.

### 5. Rejection of Claim 8 under §103(a) over Ramarathnam in view of Joyner, Jr. et al is overcome

Claim 8 has been amended to specifically interface a DMX control signal to the controller. Applicants' disclosure (pg. 8, lines 18-21) references a DMX signal to set the instantaneous desired pump flow rate. A single DMX controller can be used to independently control up to 512 separate motor pumps based on a complex set of pre-programmed external events. Such DMX controllers are used extensively to control multi-media and stage presentations. Claim 8 is novel in that it allows a motor pump to be interfaced to a complex pre-programmed external system. It would be a strained interpretation to rely on the "read set speed" step in **Ramarathnam's Fig**. 9 to base a potential **§103(a)** rejection of amended Claim 8. The "read set speed" step in **Ramarathnam's** Fig. 9 simply sets the speed from the operator console or keypad (pg. 9, lines 24-25).

### 6. Rejection of Claim 10 under §103(a) over Ramarathnam in view of Joyner, Jr. et al is overcome

Claim 10 has been amended to enunciate the patentable features of the software program disclosed in applicants' Fig. 3 and described in applicants'

disclosure. Amended Claim 10 distinguishes over **Ramarathnam** and over the prior art. Specifically, the program of amended Claim 10 computes AC pulse switching signals "*... as required to synchronously drive said motor pump at the frequency of said AC pulse switching signals and with said AC pulse switching signals having a pulse width as required to maintain synchronization of said motor pump with said AC pulse switching signals over all realizable speeds.*" This language distinguishes over **Ramarathnam** and over the prior art. Specifically, the flow chart in **Ramarathnam's** Fig. 9 computes a sine wave generated by a PWM frequency considerably higher than the motor driving frequency. It would be a strained interpretation of "program" to describe **Ramarathnam's** program with amended Claim 10. While the program in amended Claim 10 and in **Ramarathnam** both affect a change in motor speed, they do so in substantially and patentably distinguishable ways. This distinction is clearly made in amended Claim 10.

**7. Rejection of Claim 12 under §103(a) over Ramarathnam in view of Slate et al is overcome**

Claim 12 originally depended on Claim 2 (now cancelled). Claim 12 has been amended to depend on amended Claim 3 which incorporates the subject matter of cancelled Claim 2 with further limitation. Amended Claim 3 depends on amended Claim 1.

Regarding **§103(a)** rejection of Claim 12, Examiner states that **Ramarathnam** does not teach a fountain system but **Slate et al** does. Because **Slate et al** requires a motor driver, Examiner contends that "it would have been obvious to a skilled person to use Ramarathnam's motor to run the fountain system of Slate to achieve the same subject matter."

**Slate, et al** does not teach a fountain system. **Slate et al** teach an intermittently driven piston pump coupled to separate DC motors and used to

feed a fluid cassette in a pati nt fluid delivery system. This system would be wholly inappropriate to drive a fountain as enunciated in Claim 12 or for that matter any fountain designed for generating variable output flow patterns. Moreover, **Slate et al** specify a feedback controller which cannot cause a variation in output of an AC PMSM pump as in Claim 12.

**Ramarathnam** teaches a motor controller - not a motor. **Ramarathnam's** motor controller is designed to control an AC motor - not a DC motor as disclosed in **Slate et al.** (See earlier argument {Section 2-A} regarding DC motors driven as AC motors.)

Combining the AC control of **Ramarathnam** to replace the motor driver in **Slate et al** would result in an in-operative combination: **Ramarathnam's** AC control would not control the **Slate et al** DC motors without the atypical modifications required to turn the **Slate et al** motors into AC motors. One could also argue that it would be impossible to combine the two cited references to any practical effect.

Furthermore, each of the references cited by Examiner is complete within itself. There is no reason to combines the two references - especially in light of the above arguments. These are strong arguments against a **§103(a)** rejection.

Novelly, the fountain of amended Claim 12 attains an exquisite degree of control with only one moving part - the rotor in the AC PMSM pump! Using the sine wave control of **Ramarathnam,** although not suggested by Examiner, would result in substantial processor overkill and associated increased cost to control what is essentially a low cost submersible pump. Beyond this argument, amended Claim 12 results is a substantial improvement in implementation, cost and fountain maintainability over the commonly accepted dynamic fountain art of utilizing motor, pump, controller, electrically actuated valves, holding tanks and plumbing to perform the same task.

## 8. Objection of Claims 4, 7 and 13 as being dependent on a rejected base claim is overcome

Examiner rejected Claims 4, 7 and 13 as being dependent on a rejected base claim (Claim 1). Claim 1 has been amended and based on applicants' arguments, applicants submit that amended Claim 1 is clearly allowable over the prior art. Applicants' respectfully request that Claims 4, 7, and 13 be granted as objections to base Claim 1 have been addressed and overcome.

## 9. Request for Reconsideration

Claim 1 was amended to further enunciate the unique features of the invention, to further distinguish from the prior art and to more specifically overcome §103(a) objections based on **Ramarathnam** and **Ramarathnam** in view of **Joyner, et al.**

Claim 3 was amended to include the subject matter of cancelled Claim 2 with further limitation to liquid immersed rotor/impellers and to overcome §103(a) objections based on the prior art especially relative to coupling separate motors and pumps.

Claim 8 was amended to limit to DMX control and to overcome §103(a) rejection based on **Ramarathnam.**

Claim 10 has been amended to enunciate the patentable features of the software program and to overcome §103(a) objections over **Ramarathnam.**

Claim 12 was amended to depend on amended Claim 3 and to overcome §103(a) arguments based on **Ramarathnam** in view of **Slate et al.**

Dependent Claim 4, 7 and 13 depend on amended Claim 1 for which §103(a) arguments have been addressed and overcome. Applicants submit that Claims 4, 7 and 13 are now in condition for allowance.

## 10. Conclusions and R quest for Constructiv Assistance

Based on all the arguments forwarded by the applicants to counter Examiner objections and based upon changes to the claims to more clearly enunciate the novel and patentable features of the invention, the applicants submit that amended Claims 1, 3, 8,10 and 12 all define patentably over the prior art and are clearly allowable. Applicants also submit that Claims 4, 7 and 13 be granted as the basis for rejection has been corrected. Therefore applicants submit that this application is now in condition for allowance, which action they respectfully solicit.

If for any reason this application is not believed to be in full condition for allowance, applicants respectfully request the constructive assistance and suggestions of the Examiner pursuant to M.P.E.P. §21783.02 and §707.07(j) in order that applicants can place this application in allowable condition as soon as possible and without the need for further proceedings.

Very Respectfully,

Chris S. Brunt Gary R. Fisher
Applicants Pro Se

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**C rtificat of Mailing**

I hereby certify that this correspondence and attachments, if any, will be deposited with the United States Postal Service by Express Mail # ET557029455US, postage prepaid, in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date below.

Date: 15 August 2003

Inventor's Signature: